

TABLE AP1-2. 7-BAR AND 3-BAR ECM NO LONGER USED FOR NEW CONSTRUCTION, BUT STILL IN USE *
May 2010

DRAWING NO.	DRAWING		DESIGN	DDESB APPROVAL	ECM	COMMENTS: (NOTE 2)	NOTES:
(NOTE 1)	DATE	DESCRIPTION	AGENT	DATE	DESIGNATION		
1059128 through 1059132 modifications 1069906, and 1355460 through 1355461	18-Mar-64	Steel Arch	NAVFAC	1964	7-Bar	Designed for NOTS test of 18 Dec 1963. Listed in DDESB minutes as a STD ECM. NAVFAC MIL-BUL-340 (YD), Jul 93, listed this magazine design as canceled. Drawing 1351905 provided for an optional deeply corrugated, light gauge arch vice the 1 gauge specified on 1059128.	
1404000 through 1404007	1-May-78	RC Box, Type A	NAVFAC	13-Aug-82	7-Bar	Superceded Drawings 749771 through 749774 and 793751. NAVFAC MIL-BUL-340 (YD), Jul 93, lists these ECM drawings as canceled.	
1404018 through 1404025, 952132, through 952134	25-Sep-78	RC Box, Type B	NAVFAC	13-Aug-82	7-Bar	Superceded Y & D Drawings 952127 through 952131 and 952135. NAVFAC MIL-BUL 340 (YD), Jul 93, lists these ECM drawings as canceled.	
1404026 through 1404034	UNK	Steel, Oval Arch	NAVFAC	27-Jan-76	7-Bar	Listed in DDESB minutes as STD magazine. NAVFAC MIL-BUL-340 (YD), Jul 93, lists these ECM drawings as canceled.	
1404328 through 1404342	7-Aug-84	Steel Arch	NAVFAC	15-Jul-83	7-Bar	Superceded NAVFAC's original (1964) Standard Drawings (1059128 thru 1059130, 1059132, 1069906, and 1355460 thru 1355461.	
1404465 through 1404478	20-Sep-85	RC Box, Type D	NAVFAC	5-Nov-85	7-Bar	DDESB (P. Price) approval signature of 5 Nov 85 on drawings. Sited for 350,000 pounds NEW. Superceded by NAVFAC Drawings 6448522 through 6448554 (Standard Box Magazine Type D) and NAVFAC Drawings 6448555 through 6448588 (HSILS Box Magazine Type D), both dated 27 May 97 .	
1404541 through 1404555	9-Jun-87	RC Box, Type F	NAVFAC	17-Jul-87	7-Bar	Superceded by NAVFAC Drawings 6448589 through 6448621. This magazine design was sited for 350,000 pounds NEW. A site specific site approval was granted to Naval Weapons Station, Seal Beach, for the construction of four Box Type F Magazines with the dehumidification system located on top of the magazine, vice behind the magazines as was shown on the approved design drawings. This modification was not approved by the DDESB as a standard design, since the Navy never came in with a modified standard magazine drawing set to incorporate the addition of the dehumidification system onto the magazine roof.	
219-25-321	23-Apr-90	RC FRELOC Stradley	COE (Sacramento District)	Acceptance based on COE analysis	7-Bar	This design was constructed at Luke AFB. It was evaluated by the COE, Huntsville, to determine its structural rating. Their analysis, documented on memo CEHNC-ED-CS-S (210-2b) of 23 January 2002, found that the design shown on the drawings came from existing 7-Bar ECM design 33-15-74.	

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33-03-0028	20-Jun-88	RC Stradley	COE (Pacific Ocean District)	Acceptance based on COE analysis	7-Bar	This design was constructed at Osan Air Base, Korea and is based on OCE Drawing 33-15-61, 30 Dec 1959, which is considered a 7-Bar ECM. The drawings provides for two different ECM designs. One design is a typical ECM with a single headwall and the ventilator out the rear of the ECM, while the second design includes two headwalls and a ventilator that is centered on the roof of the ECM. Based on a review by the Huntsville COE, the headwall and doors used on 33-03-0028 match the headwall and doors of 33-15-61. The doors of the three designs are all 6-foot wide sliding doors. Two of these doors are required per entrance.	
33-03-31	UNK	RC FRELOC Stradley	U.S. Army Engineer Command (Europe)	1978	7-Bar	This design is similar to 33-15-61, the DDESB approved Standard Freloc-Stradley Magazine. 33-03-31 was designed for construction at VILSECK ASP-1 (Germany) for USAF. It measured 26' W X 80' L and had a ceiling height of 14' at the centerline. The entrance measured approximately 10' by 10'. It had a reinforced concrete arch of uniform thickness, a heavily reinforced headwall, and bi-parting, double-leaf steel doors. A Sep 1977 dynamic analysis of this Freloc design, performed by Agbabian Associates for the COE, European Division, determined that the headwall was sufficiently strong to meet NATO face-on loading criterion, but the door was not. Recommendations were provided in Agbabian Associates Report R-7745-4503 to strengthen the doors by adding additional horizontal and vertical stiffeners on the exterior side of the doors. DDESB-KT Memos of 27 Jan and 4 May 1978 states that the door of the ECM analyzed by Agbabian Associates (33-03-31) met U.S. standard magazine criteria.	
33-03-43	1-Apr-76	RC Arch	COE, Europe Division	19-Mar-76	7-Bar, See Comment section.	Known as a Quick Reaction Site (QRS) magazine, which were only constructed in Germany. Permitted to store a maximum of 4,000 kg NEQ. DDESB-KT Memo of 19 March 1976 evaluated this design and compared its structural components to counterpart features of standard ECM, particularly those in 33-15-61 and 33-15-64, which had undergone extensive testing. Based on this review, the design was approved for the storage of 4,000 kg NEQ in each arch unit. In addition, the design of the door was considered to qualify the ECM design for the minimum separation distances permitted.	
33-13-02	15-May-51	RC Stradley	OCE	26-Jan-99	7-Bar	A COE, Huntsville, letter of 13 Apr 98 determined this ECM was a revision of 33-15-06 (a 7-Bar ECM) and recommended it be considered a 7-Bar ECM as well. A 26 Jan 99 DDESB ltr approved use of ECM constructed in accordance with Drawing 33-13-02, as a 7-Bar magazine.	3
33-15-01	1-Jul-78	RC Stradley	COE (Omaha District)	Acceptance based on DDESB comparison to existing approved 7-Bar ALCM design.	7-Bar	A double-headwall (flow-through) design with two sliding door on each headwall. The headwall and door design are consistent with the COE, Omaha District, ALCM magazine design (AW 33-15-01), a 7-Bar design.	

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(NOTE 1)	DATE	DESCRIPTION	AGENT	DATE	DESIGNATION		
AW 33-15-01	1979	RC Stradley	COE (Omaha District)	26-Feb-80	7-Bar	This design was known as the Air Launched Cruise Missile (ALCM) Igloo and is a double-headwall (flow-through) design with two large sliding doors on each headwall. The design provides 7-Bar protection. A 26 Feb 1980 DDESB letter approved AW 33-15-01 as a typical layout for ALCM storage and considered this design equal to a standard ECM. There are two designs in existence, with the only differences being the footings and floor slab. The initial design constructed at Griffis AFB, NY, had wall footings and a floating slab-on-grade. The subsequent design revised the foundation and flooring to a mat foundation slab. The subsequent design is believed to have been constructed at the following Air Force Bases: Grand Forks, ND; Minot, ND; Fairchild, WA; Ellsworth, SD; Wurtsmith, WI; K.I. Sawyer, MI; Barksdale, LA; Blythville, AR; McConnell, KS; Carswell, TX; and Andersen, Guam. Internal dimensions are 40' wide by 112' long by 18'6" high along the longitudinal centerline. Each of the sliding doors measures 18' 10" long by 13' 7 5/8" high.	
AW 33-15-02	21-Aug-67	RC Arch	COE (Los Angeles District)	Acceptance based on COE analysis	7-Bar	Constructed at Luke AFB. Analyzed by COE, Huntsville, to determine its structural rating. Their analysis, documented on memo CEHNC-ED-CS-S (210-2b) of 23 January 2002, found that the design of the headwall and door meets 7-Bar criteria.	
33-15-02	1-Jul-78	Steel, Oval Arch	COE (Omaha District)	Acceptance based on DDESB comparison to existing approved 7-Bar ALCM design.	7-Bar	A double-headwall (flow-through) design with a single sliding door on each headwall. The headwall and door design are consistent with the COE, Omaha District, ALCM magazine design (AW 33-15-01), a 7-Bar design.	
33-15-02	1-May-51	RC Arch	COE (Little Rock Division)	Acceptance based on COE analysis	7-Bar	Constructed at Barksdale AFB, LA. Analyzed by COE, Huntsville, AL, to determine structural rating. Their analysis, documented on memo CEHNC-ED-CS-S of 15 July 2003, found that the design of the headwall and doors met 7-Bar criteria.	
33-15-03	1-Jul-78	RC Stradley	COE (Omaha District)	Acceptance based on DDESB comparison to existing approved 7-Bar ALCM design.	7-Bar	A double-headwall (flow-through) design with a single sliding door on each headwall. The headwall and door design are consistent with the COE, Omaha District ALCM magazine design. Similar design to Omaha District 33-15-01, but with a larger door opening.	
33-15-04	1-Jul-78	Steel, Oval Arch	COE (Omaha District)	Acceptance based on DDESB comparison to existing approved 7-Bar ALCM design.	7-Bar	A double-headwall (flow-through) design with a single sliding door on each headwall. The headwall and door design are consistent with the COE, Omaha District ALCM magazine design. Similar design to Omaha District 33-15-02, but with a larger door opening.	
33-15-06	1-Aug-51	RC Arch	OCE	29-Jul-55	7-Bar	Previously called the "YURT" Magazine. This magazine design superceded Drawings 652-686 through 652-693 and OCE 33-15-01 (1941 design - see Table AP1-3). A 1 Apr 87 COEHQ letter stated that ECM design 33-15-06 was no longer being used for new construction.	4

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33-15-13	16-Jan-68	RC FRELOC Stradley	U.S. Army Engineer Command (Europe)	19-Aug-75	7-Bar	A 4 May 78 DDESB letter restated that 33-15-13 was a standard ECM and that variations of this design were acceptable, provided new designs were at least equal to it structurally. This design is known as the "thin-wall" magazine and is known to have been built at Camp Darby, Italy. Similar designs, based on the 33-15-13 design are known to have been constructed in Germany and elsewhere.	
33-15-15	UNK	Modified FRELOC Stradley (Steel Oval Arch)	U.S. Army Engineer Command (Europe)	22-Apr-80	7-Bar	This design includes a double leaf door system, similar to the 33-15-61 two-leaf sliding door tested as aprt of ESKIMO II.	
33-15-16	26-Mar-79	RC FRELOC Stradley	U.S. Army Engineer Command (Europe)	1-Apr-79	7-Bar	Also known as the "TYPE 16" Magazine. This design corrected strength deficiencies found in ECM design 33-15-14, which was determined to be a non-standard ECM.	
33-15-208	UNK	Steel Arch	U.S. Army Engineer Command (Europe)	7-Aug-87	7-Bar	Replaced design 33-15-28 that was previously approved by DDESB for construction at Larson Barracks, Kitzingen, GE. This design has only one entrance vice the 2 shown on 33-15-28.	
33-15-28	UNK	Steel Arch	U.S. Army Engineer Command (Europe)	11-May-83	7-Bar	Constructed at Larson Barracks, Kitzingen, GE. Based on QRS magazine, which were only constructed in Germany (see 33-03-43 design). This design had 2 front headwalls and doors and no rear wall.	
33-15-58	3-Feb-58	RC Stradley	OCE	14-Oct-70	7-Bar	Approved during 259th ASES meeting of 14 Oct 70 and was considered to be atomic blast resistant. This drawing replaced former drawings YT-1-1 through YT-111. At that meeting, the Chairman, ASES, also read into the record that Stradley (Yurt) magazines which are constructed in accordance with Standard OCE Drawings 33-15-58 and/or 33-15-61 are considered to be equivalent in strength to the OCE's standard earth covered igloo magazines.	
33-15-61	30-Dec-59	RC Stradley	OCE	14-Oct-70	7-Bar	Approved during 259th ASES meeting of 14 Oct 70. This drawing replaced former drawings YT-1-1 through YT-111. At that meeting, the Chairman, ASES, also read into the record that Stradley (Yurt) magazines which are constructed in accordance with Standard OCE Drawings 33-15-58 and/or 33-15-61 are considered to be equivalent in strength to the OCE's standard earth covered igloo magazines. Two door sizes are shown on the drawing: a 10' X 10' door and a 12' X 12' door. DDESB memo of 22 Apr 1980 discusses the successful testing of the two-leaf sliding door of 33-15-61 as part of ESKIMO II.	

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33-15-61-6	UNK	RC Stradley	UNK	Acceptance based on COE analysis	7-Bar	Very similar to 33-15-61, which is a 7-Bar ECM. Only differences were the use of a 10' door and 3,000 psi concrete vice a 12' door and 2,500 psi concrete. Doors and headwall were analyzed and were found to meet 7-Bar criteria. COE Huntsville e-mail of 24 January 2003 to DDESB documents results of review and analysis.	
33-15-62	13-Jan-60	N/A	OCE	12-Dec-75	N/A	This is not an ECM design drawing. This drawing permitted installation of larger doors on specific magazines, on the basis that the strength of the modified structures remained unchanged as a result of the door modifications. This drawing applied to ECM 33-15-01, 33-15-06, and 652-686 through 652-692.	
AW 33-15-63	5-Mar-63	Steel, Semi-Circular Arch	OCE	19-Feb-64	See note 5	Approved during 225th ASES meeting of 19 Feb 64 as a standard magazine design. A 1 Apr 87 COEHQ letter stated that ECM design AW 33-15-63 was no longer being used for new construction. Drawing AW 33-15-63 had two designs shown on it. One is a traditional magazine with a single 12-inch thick reinforced concrete headwall, while the second is a design with two headwalls and doors (flow through design). COE structural evaluation of AW 33-15-63 door in 2003 determined the door would not provide 7 or 3-Bar protection.	5
AW 33-15-64	10-May-63	Steel Arch	OCE	19-Feb-64	See note 5	Approved during 225th ASES meeting of 19 Feb 64 as a standard magazine design. A 1 Apr 87 COEHQ letter stated that ECM design AW 33-15-64 was no longer being used for new construction. COE structural evaluation of AW 33-15-64 door in 2003 determined the door would not provide 7 or 3-Bar protection.	5
AD 33-15-67 R2	5/8/1964, Rev 2 dated 8 Mar 65	Steel, Semi-Circular Arch	AF	See comment	See note 5	This ECM was required to be constructed IAW Drawing AW 33-15-63. A 13 Jan 1995 COE, Huntsville Division, ltr stated that since the design drawing calls for it to be constructed in accordance with a standard (7-Bar) design, then, by analogy, it also should be considered a standard. Added to the magazine listing in DoD 6055.9-STD, based on COE analysis. COE structural evaluation of AW 33-15-63 door in 2003 determined the door would not provide 7 or 3-Bar protection.	5
AD 33-15-68 R2	5/8/1964, Rev 2 dated 8 Mar 65	Steel, Semi-Circular Arch	AF	See comment	See note 5	This ECM was required to be constructed IAW Drawing AW 33-15-63. A 13 Jan 1995 COE, Huntsville Division, ltr stated that since the design drawing calls for it to be constructed in accordance with a standard (7-Bar) design, then, by analogy, it also should be considered a standard. Added to the magazine listing in DoD 6055.9-STD, based on COE analysis. COE structural evaluation of AW 33-15-63 door in 2003 determined the door would not provide 7 or 3-Bar protection.	5

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AD 33-15-69 R2	8-May-64	Steel, Semi-Circular Arch	AF	See comment	See note 5	This ECM was required to be constructed IAW Drawing AW 33-15-63. A 13 Jan 1995 COE, Huntsville Division, ltr stated that since the design drawing calls for it to be constructed in accordance with a standard (7-Bar) design, then, by analogy, it also should be considered a standard. Added to the magazine listing in DoD 6055.9-STD, based on COE analysis. COE structural evaluation of AW 33-15-63 door in 2003 determined the door would not provide 7or 3-Bar protection.	5
AD 33-15-70 R1	8-May-64	Steel, Semi-Circular Arch	AF	See comment	See note 5	This ECM was required to be constructed IAW Drawing AW 33-15-64. A 13 Jan 1995 COE, Huntsville Division, ltr stated that since the design drawing calls for it to be constructed in accordance with a standard (7-Bar) design, then, by analogy, it also should be considered a standard. Added to the magazine listing in DoD 6055.9-STD, based on COE analysis. COE structural evaluation of AW 33-15-64 door in 2003 determined the door would not provide 7or 3-Bar protection.	5
33-15-73	21 Feb 75, Revised 23 Sep 77	Steel, Oval Arch	OCE	7-Feb-75	7-Bar	A 1 Apr 87 COEHQ letter stated that ECM design 33-15-73 was no longer being used for new construction. A 25 Feb 1985 OCE ltr had rescinded use of this design, due to excessive deflections that could occur at the crown of the steel arch, due to the weight of the earth cover, and as a result of the collapse of an ECM in the field because of this problem. A 7 Feb 1975 DDESB memorandum approved OCE 33-15-73 (Oval Steel Arch) as a substitute igloo for AW 33-15-64, for use for any application for which a standard igloo is specified. This memorandum was in response to a Ft. Leonard Wood project (Project No. 109,Ammunition Storage Facility). Superseded by 421-80-01.	
33-31-01	UNK	RC Arch	UNK	4-May-99	7-Bar	DDESB letter of 4 May 1999 identifies this magazine as being located at Incirlik AFB, Turkey. Dr. Canada of the DDESB evaluated the strength of this ECM design located at Incirlik AFB.	
33-31(JCASE)-01	UNK	RC Arch	UNK	4-May-99	3-Bar	DDESB letter of 4 May 1999 identifies this magazine as being located at Incirlik AFB, Turkey. Its blast door was determined to be incapable of providing 7-Bar protection, although the magazine arch and headwall were designed to meet 7-Bar criteria. Dr. Canada of the DDESB evaluated the strength of this ECM design located at Incirlik AFB.	

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FI-350 through FI-356	18-Apr-51	RC Arch	OCE	Acceptance based on COE analysis	7-Bar	This Black and Veatch design was constructed at Rapid City Air Force Base (now known as Ellsworth AFB), Rapid City, SD. The Huntsville District COE reviewed this design and determined the design met 7-Bar criteria. Their results are documented on CEHNC-ED-CS-S (210-20b) of 6 March 2003. Some of the the magazines were subsequently modified with larger doors, as shown on COE Omaha District Drawing AW 33-13-01, dated 18 May 1960. The original door measures 9'11 3/4" H X 8 5 1/2" W (double, hinged, swinging doors), while the modified larger door measures 11' H X 10' 1 1/2" W and are also double, hinged, swinging door. The magazine with the modified door is treated as an Undefined ECM.	
TLDI 350, 355, 356, 359	1-May-54	RC Arch	COE (Little Rock Division)	Acceptance based on COE analysis	7-Bar	Located at Barksdale AFB, LA. CEHNC-ED-CS-S Memorandum of 18 February 2003, Subj: Analysis of Special Igloos applies. This analysis was for 33-15-02. DDESB-PD Memorandum for Record of 24 April 2007 records that this design is similar to 33-15-02, 1 May 51, COE (Little Rock Division), an approved 7-Bar design.	
357428 through 357430, modified IAW OCE Drawing 626739	9 Aug 44, modification 19 Mar 54	RC Arch	Bureau Y&D	25-Oct-56	7-Bar	This magazine design, modified with an Army blast door, was successfully tested in 1946 at Naval Proving Ground, Arco, Idaho, with an NEW of 500,000 pounds NEW. Refer to paragraph 2.3.5 of TP 15 for additional information regarding the test. DoD 4145.27M, March 1969 permitted this ECM to be separated by 210 feet for quantities up to 250,000 pounds NEW and 400 feet for quantities between 250,000 pounds and 500,000 pounds NEW. The 1 December 1955 ASESQ QD Standards permitted this ECM design, if it had been modified IAW Bureau Y&D Drawing 626739, dated 19 Mar 54, to use a 185-foot separation distance for quantities up to 500,000 pounds NEW. If not, then a minimum separation distance of 210 feet was required for NEW quantities up to 250,000 pounds and a 400-foot separation distance was required for NEW quantities from 250,000 to 500,000 pounds. Paragraph 2.3.5.3. of TP 15 provides additional information to address the door, with respect to the nine year gap between when the 1946 test occurred and 1954, when Bureau Y&D Drawing 626739 was approved. Bureau Y&D Drawing 626739 provided for a 13-inch thick headwall and improved door design.	
421-80-02	15-Dec-92	Composite Box	COE	1-Mar-00	7-Bar	This magazine uses a Blast and Fragment Resistant (BFR) wall system that is also known as the AGAN Steel Panel (ASP) System. Removed from the authorized new construction list on the advice of Huntsville Division COE, as the U.S. distributor for this magazine design is no longer in business.	

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422-80-01	1-Nov-95	RC Stradley	COE (Omaha District)	Acceptance based on DDESB comparison to existing approved 7-Bar ALCM design.	7-Bar	Constructed at McConnell AFB, KS. This design is based on Air Launched Cruise Missile(ALCM) Igloo AW 33-15-01 and is a double-headwall (flow-through) design with double (2) sliding doors on each headwall. The design provides 7-Bar protection. A 26 Feb 1980 DDESB letter approved AW 33-15-01 as a typical layout for ALCM storage and considered this design equal to a standard ECM. Internal dimensions are 40' wide by 112' long by 18'6" high along the longitudinal centerline. Each of the sliding doors measures 18' 10" long by 13' 7 5/8" high.	
422-264-001	1-Aug-93	RC Stradley	COE (Omaha District)	26-Feb-80	7-Bar	Constructed at Whiteman AFB, MO. This design is based on Air Launched Cruise Missile(ALCM) Igloo AW 33-15-01 and is a double-headwall (flow-through) design with double (2) sliding doors on each headwall. The design provides 7-Bar protection. A 26 Feb 1980 DDESB letter approved AW 33-15-01 as a typical layout for ALCM storage and considered this design equal to a standard ECM. Internal dimensions are 40' wide by 112' long by 18'6" high along the longitudinal centerline. Each of the sliding doors measures 18' 10" long by 13' 7 5/8" high.	
4374567 through 4374578	UNK	M-Type RC Box	NAVFACNA VFAC, Atlantic Division	1-Dec-99	7-Bar	This design superceded the initial M-Type magazine design constructed at NWS Seal Beach, CA (see 8027514 through 8027532). The DDESB approved the modified Type M magazine as a "default", 7-bar structure for storage of up to 350,000 pounds of HD 1 .1 explosives and approved the siting of 14 Type M (modified) magazines at WPNSTA, Yorktown. The proposed modification increased the ceiling height by four (4) feet and upgraded the magazine's foundation to carry the additional weight of the increased height. Two of the 14 ECMs constructed have foundations with slightly less carrying capacity. This is because their construction was started as the Type M design was evolving.	
5167368 through 5167413	21-Aug-87	RC Arch	NAVFAC	6-May-85	7-Bar	This is a magazine design developed for storage of Trident rocket motor storage at Kings Bay, GA. The headwall/door design from this magazine was also used to upgrade existing Huntsville-type (drawings 1012 through 1014) constructed at Camp Navajo (formerly Navajo Ammunition Depot), see NAVFAC Drawings 8150953 through 8150971.	
627954 thr 627957, 751861, 764597, 793747	5-Apr-54	RC Arch, Type 1	Bureau Y&D	7-May-54	7-Bar	Listed in 1954 DDESB minutes as Standard ECM. This design was an original Bureau Y&D Standard. The 1 Dec 55 ASESQ QD Standards listed ECM 627954 through 627957 as a Standard ECM for storage of NEW up to 500,000 pounds. A 185-foot separation distance was required from other magazines. Bureau Y&D Drawing 817104 provides general information regarding this ECM and was used for planning purposes.	

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652-686 through 652-692	27 Dec 41, Revised 14 Mar 42	RC Arch	OCE	24-Dec-98	7-Bar if proper spacing provided, See Comment.	This ECM design was tested as part of the 1946 Naval Proving Grounds, Arco, Idaho, tests. The 130th ASES (18 May 53) acknowledged COE Drawings 652-686 through 652-694, dated 27 Dec 41, revised 14 Mar 42, as a Standard ECM. 1Dec 55 ASES QD Standards list this ECM as a standard, with 185-foot separation for barricaded, 360-foot separation for unbarricaded. A 24 Dec 98 DDESB ltr states that an ECM constructed to Drawings 652-686 through 652-692 is not robust enough to qualify as a 7-Bar ECM. However, it is robust enough to protect its contents if it is spaced about 400 feet from a detonation of 500,000 pounds NEW in an adjacent ECM. In addition, these ECM constructed with "Medium" or "Rock Only" footings do not satisfy present requirements for electrically continuous reinforcing steel, therefore ECM with these type footings do not meet current lightning protection criteria. Superseded by 33-15-01, .	
6521000 through 6521010	19 Feb & 23 Mar 42	RC Dome	OCE	12-Jul-90	7-Bar if proper spacing provided, See Comment and Note 6.	Called a Corbetta, Beehive, or Dome Magazine. At a 23 Feb 1942 meeting, the Joint Army and Navy Board of Ammunition Storage (predecessor of ASES) approved the Corbetta Magazine as an alternate type magazine (i.e. Non-Standard). A 12 Jul 90 DDESB ltr approved a 27 Nov 89 COE ltr, requesting approval to modify doors on Corbetta Type ECM at Volunteer Army Ammunition Plant (AAP) and Holston AAP. Once modified, each ECM can be sited for 500,000 pounds NEW, provided the conditions of Note 6 below were met. If they cannot be met, then the ECM must be treated as a non-standard.	6
658384 through 658388, modifications 724368, 764596, and 793746	23-Nov-54	RC Arch	Bureau Y&D	9-May-84	7-Bar	Listed in 1954 DDESB minutes as Standard ECM. This design was an original Bureau Y&D Standard. The 1 Dec 55 ASES QD Standards listed ECM 658384 through 658388 as a standard ECM for storage of NEW up to 500,000 pounds. A 185-foot separation distance was required from other ECM. Superseded by NAVFAC Drawings 1404310 through 1404324. Bureau Y&D Drawing 817103 provides general information regarding this ECM and was used for planning purposes.	
*718313401 through 718313405	21-Jul-41	RC Arch	OQMG	10-Dec-04	7-Bar	Approved as 7-Bar ECM based on DDESB review of 25 February 1998 Huntsville District, Corps of Engineers evaluation of the design that determined it was similar to 652-686 through 652-692. These design was constructed at Milan AAP.	
725738 through 725746	9-Sep-56	RC Stradley	Bureau Y&D	Acceptance based on COE analysis	7-Bar	COE Huntsville memo (CEHNC-ED-CS-S (210-2b) of 27 June 2002, subject: 7-Bar Magazines, states that the magazines constructed to this drawing at Moron Air Base, Spain, are 7-Bar ECM. The basis for their determination is that this design is identical to 33-13-02, which is a 7-Bar design.	

TABLE AP1-2. 7-BAR AND 3-BAR ECM NO LONGER USED FOR NEW CONSTRUCTION, BUT STILL IN USE *
May 2010

DRAWING NO.	DRAWING		DESIGN	DDESB APPROVAL	ECM	COMMENTS: (NOTE 2)	NOTES:
(NOTE 1)	DATE	DESCRIPTION	AGENT	DATE	DESIGNATION		
8027514 through 8027532	1990	RC Box	NAVFAC SW Division	9-Apr-93	7-Bar	Initial M-Type Navy magazine designed for and constructed at NWS Seal Beach, CA as part of MILCOM P-137. Approved as a site-adaptable magazine with a maximum NEW of 350,000 lbs NEW. Subsequently modified and constructed at NWS Yorktown. Replaced by NAVFAC Drawings 10400001 through 10400027 for new construction.	
8150917 through 8150988	10/19/2002 (final)	RC Arch	NAVFAC	26-Dec-96	7-Bar	As part of FY2001 MILCON Project P-114, this design modified eight existing Undefined ECM built in the 1940s timeframe (Huntsville Type 652-1012 through 652-1014, with inadequate headwall reinforcing steel) by replacing their headwalls and doors with those that met 7-Bar criteria. This occurred at Army National Guard Training Site, Camp Navajo, AZ. The new headwall and door, a single sliding door, are similar to NAVFAC headwall and door designs (drawings 5167380 through 5167413) previously approved by DDESB at SUBASE Kings Bay, SC.	
Incirlik, Turkey (Cephane Deposu) ECM	UNK	Modifed RC Stradley	UNK	4-May-96	3-Bar	DDESB letter of 4 May 1999 identifies this magazine as being located at Incirlik AFB, Turkey. Its blast door was determined to be incapable of providing 7-Bar protection, although the magazine arch and headwall were designed to meet 7-Bar criteria. Dr. Canada of the DDESB evaluated the strength of this ECM design located at Incirlik AFB.	
Incirlik Turkey ECM	UNK	RC Arch	UNK	4-May-96	3-Bar	DDESB letter of 4 May 1999 identifies four ECM (1995, 2059 (Modified NATO-16), 2323, and 2327) as being located at Incirlik AFB, Turkey. These four ECM were evaluated by Dr. Canada of the DDESB and determined to be as follows: 2059 and 2323 are 3-Bar ECM, and 1995 and 2327 are 7-Bar ECM. The blast doors of the 3-Bar ECM were determined to be incapable of providing 7-Bar protection, although the magazine arch and headwall were designed to meet 7-Bar criteria.	
Lone Star AAP ECM	UNK	RC Arch	UNK	13-Jul-99	3-Bar	A 23 Sep 89 site visit to Lone Star, by Adib Farsoun of the Huntsville Division, Corps of Engineers (Code CEHND-ED-CS) concluded that the Lone Star magazines were almost equivalent to standard ECM design 33-15-06 with one exception: 33-15-06 had a double leaf door as compared to a single leaf door on the Lone Star magazines. In addition, magazines are sited 400 feet apart. On this basis, DDESB determined that magazines equivalent to those at Lone Star AAP may be treated as 3-Bar magazines and are authorized to contain up to 500,000 pounds NEW OF HD 1.1.	

TABLE AP1-2. 7-BAR AND 3-BAR ECM NO LONGER USED FOR NEW CONSTRUCTION, BUT STILL IN USE *
May 2010

DRAWING NO.	DRAWING		DESIGN	DDESB APPROVAL	ECM	COMMENTS: (NOTE 2)	NOTES:
(NOTE 1)	DATE	DESCRIPTION	AGENT	DATE	DESIGNATION		
Munitionslagerhaue (MLH) 25	UNK	RC Portal Type	German	2-Dec-77	7-Bar	DDESB determined that MLH 25, MLH 90, and MLH 180 ECM designs could be equated to a standard igloo. Construction of 19 of these magazines was approved for Forward Storage Site (FSTS) Ottrau, Germany. Maximum explosives limit assigned to this ECM design, as a standard magazine was 37,500 kg (82,753 pounds). The Ottrau ECM were separated at 25 meters (side-to-side).	
Munitionslagerhaue (MLH) 30	UNK	RC Box	German	18-Aug-87	7-Bar	Approval was on the basis of the 12 Dec 77 DDESB letter that determined the MLH design could be equated to a standard ECM. Separation distances were $d=1.25W^{1/3}$ (side to side) and $d=2.00W^{1/3}$ (front to rear), which were used at the time to site standard magazines. Approved maximum limit for this design is 77,900 kg (171,884 pounds). The minimum side to side distance used was 25 m (82 feet). The site plan to construct 20 magazines at FSTS Seckach (Kuelsheim), GE was approved.	
Munitionslagerhaue (MLH) 50	UNK	RC Box	German	02/10/82 & 08/18/1987	7-Bar	DDESB approved the construction of seventeen MLH 180, six MLH 90, and three MLH 50 at FSTS Grebenhain, Germany. Approval was on the basis of the 12 Dec 77 DDESB letter that determined the MLH design could be equated to a standard ECM. Separation distances were $d=1.25W^{1/3}$ (side to side) and $d=2.00W^{1/3}$ (front to rear), which were used at the time to site standard magazines. Approved maximum limit for this design is 77,900 kg (171,884 pounds). The minimum side to side distance used was 25 m (82 feet).	
Munitionslagerhaue (MLH) 60B	UNK	RC Box	German	18-Aug-87	7-Bar, See Comment section.	NATO explosives safety standards limit this magazine to an NEQ of HD 1.1 of 75,000 kg (165,000 pounds NEW). For siting at U.S installations, where encumbered land is completely within U.S owned or controlled property, an explosives limit of 250,000 pounds NEW can be used for siting purposes. Considered a standard (7-Bar) ECM for sitings involving 165,000 pounds NEW or less.	
Munitionslagerhaue (MLH) 148, Dwg 41214	16-Feb-87	RC Box	German	28-Jun-88	7-Bar, See Comment section.	NATO explosives safety standards limit this magazine to an NEQ of HD 1.1 of 75,000 kg (165,000 pounds NEW). For siting at U.S installations, where encumbered land is completely within U.S owned or controlled property, an explosives limit of 250,000 pounds NEW can be used for siting purposes. Considered a standard (7-Bar) ECM for sitings involving 165,000 pounds NEW or less.	
Volkel (Netherlands)	UNK	RC Stradley	Netherlands	31-Mar-99	7-Bar	DDESB letter of 31 March 1999 determined that the ECM in Block A at Volkel Air Base (Netherlands) met the criteria of 7-Bar ECM, based on an evaluation of Dr. Canada of the DDESB. The Strengths of the ECM in Blocks B and C could not be determined due to insufficient information.	

TABLE AP1-2. 7-BAR AND 3-BAR ECM NO LONGER USED FOR NEW CONSTRUCTION, BUT STILL IN USE *
May 2010

DRAWING NO.	DRAWING		DESIGN	DDESB APPROVAL	ECM	COMMENTS: (NOTE 2)	NOTES:
(NOTE 1)	DATE	DESCRIPTION	AGENT	DATE	DESIGNATION		
RAF Lakenheath, UK	see comments	various - see comments	UK	5-Apr-06	7-Bar	As part of a project to build 2 new 14-foot MSM (Modified 421-80-06) ECM at RAF Lakenheath, the Huntsville District COE (HNC) performed structural analyses of existing ECM in Areas 1 and 2 to determine their structural hardness for siting purposes. Area 1 consisted of 2 ECM types - a RC flat roof and a RC arch; while Area 2 contained only a flat-roof ECM. Based on the assessment, the Area 1 ECM are considered as 7-Bar with allowable, maximum NEW of 363,000 lbs HD 1.1 (reference: HNC-ED-CS-S-05-02, Rev 1, July 2005). The ECM in Area 2, is also considered a 7-Bar ECM for an allowable, maximum NEW of 100,000 lbs HD 1.1 (reference:HNC-ED-CS-S-06-1 March 2006). Refer to DDESB-PE memo of 5 April 2006 for specific requirements/conditions.	

* Could be used for new construction with DoD Component approval, but must be evaluated to insure current requirements for grounding, lightning protection, etc., are met.

Notes accompanying Table AP1-2:

1. Each line represents a separate ECM design. Where UNK appears, it indicates that no information has been found to fill in that particular field. Table 4-2 lists magazines that have been constructed in the past and are still in use today, though they generally are no longer being used for new construction. However, at the discretion of DoD Components, these designs could be used for new construction, but the designs will need to be closely evaluated to insure current DoD requirements for ECM (e.g., grounding, lightning protection, earth-cover slope and depth, structural hardness) are met.
2. 7-Bar and 3-Bar ECM are permitted to store up to 500,000 pounds, unless otherwise noted.
3. A provision of the approval was that the separation distances between the rear or side of these ECMs, as the PES, to the front of one of these ECMs, as an ES, were at least 360 feet. Side to side exposures between the PES and the ES are required to be separated in accordance with the appropriate entries for either 3-bar or 7-bar ECMs in accordance with Table 9-5 of DoD 6055.9-STD.
4. ECM separation distances based in the following criteria: Side-to- side: use $1.5W^{1/3}$; back-to-back: use $1.5W^{1/3}$; front-to-back: use $4.5W^{1/3}$.
5. The conversion of these designs from Standard magazines to 7-Bar magazines in the early 1990s was in error in that the hinged doors of AW 33-15-63, AW 33-15-64 and 33-15-65 (all similar door designs) are not capable of providing 7 or 3-Bar protection to their contents. This determination was arrived at during ESKIMO III, which tested an AW 33-5-64 design and by a structural analysis of the door design that was conducted by the Huntsville COE at the request of DDESB-KT. Paragraph C2.3.7.3. **ESKIMO III, June 1974** provides further information regarding this test. If different doors than those shown of AW 33-15-63, AW 33-15-64, and 33-15-65 have been installed, then the headwall and alternate door(s) can be structurally evaluated to determine their strength. As a result of the ESKIMO series tests, Services began moving towards single and bi-sliding doors on hardened headwall pilasters and header.

Siting guidance: Do not use for new construction. Site existing magazines as :Undefined” structures to provide a higher level of protection to contents. Use of the K4.5 that is permitted for 7-Bar ECM (face-to-face) with intervening barricades or the K6 permitted for 7-Bar ECM (face-to-face) without a barricade provides a very high likelihood of prompt propagation between ECM designed to AW 33-15-63, AW 33-15-64 and 33-15-65.
6. A Corbetta-type ECM is considered as “Undefined” because its door is inadequate to prevent explosion communication. However, in 1990, the DDESB approved two improved door designs for installation onto Corbetta-type ECM. If modified with the

new doors, and provided they meet minimum separation distances of 400 feet, side-to-side or rear-to-front exposures between the donor and acceptor ECM and (K11) front-to-front exposures between the donor and acceptor ECM, then storage of up to 500,000 pounds NEW of HD 1.1 is permitted in modified Corbetta-type ECM.